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ABSTRACT

Behaviorism was the dominant epistemology in education approximately 20 years ago, while constructivism has most recently been the dominant epistemology in the field. In this paper, differences between the assumptions of behaviorism and constructivism are briefly identified, and the behaviorist pedagogy of Individually-Guided Education and the constructivist pedagogy of Problem-Based Learning are analyzed across six core elements of the instructional environment, including learning goals, instructional approaches, teacher's role, students' roles, resource utilization, and evaluation strategies. In conclusion, the authors discuss the similarities in pedagogy resulting from two very different epistemologies. (Contains 32 references.) (Author/MES)

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INDIVIDUALLY-GUIDED EDUCATION AND PROBLEM-BASED LEARNING: A COMPARISON OF PEDAGOGICAL APPROACHES FROM DIFFERENT EPISTEMOLOGICAL VIEWS

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Abstract

Behaviorism was the dominant epistemology in education approximately 20 years ago, while Constructivism has most recently been the dominant epistemology in the field. In this paper, differences between the assumptions of behaviorism and constructivism are briefly identified, and subsequently, the behaviorist pedagogy of Individually-Guided Education and the constructivist pedagogy of Problem-Based Learning are analyzed across six core elements of the instructional environment, including learning goals, instructional approaches, teacher's role, students' roles, resource utilization and evaluation strategies. In conclusion, the authors discuss the similarities in pedagogy resulting from two very different epistemologies.

Introduction

Behaviorism was the dominant epistemology in education during the 1970s and '80s, while constructivism is currently the dominant epistemology in the field. Although they are different epistemologies, some of resulting pedagogical approaches have points in common and are worth further discussion. Under the underpinning of behaviorism, individualized instruction was developed in the 1960s and gradually reached its peak in the end of 1970s. Individually-Guided Education (IGE) is one represented approach to individualized instruction. On the other hand, the most common approach that reflects the constructivist epistemology is Problem-Based Learning (PBL), which was originally applied in medical schools in 1970s and was further developed by constructivists in the 1990's.

In this paper, the assumptions underlying behaviorism and constructivism will be briefly outlined in respect to their particular views related to reality, knowledge, the nature of learning and the purpose of instruction. Secondly, IGE and PBL approaches will be discussed as they relate to six key elements of instruction.

Assumptions of Behaviorism

The behaviorist epistemology is grounded in objectivism, which assumes that there is a single reality external to individuals. Based on this objectivist worldview, behaviorists argue that learners "acquire" knowledge from outside resources by engaging in learning activities (Ertmer & Newby, 1993). Ertmer and Newby describe the behaviorist position as one in which knowledge results when a learner "finds" it somewhere outside himself, and therefore, learning must be seen from the behaviorist view as a process of actively setting about to acquire knowledge. In order to help learners acquire knowledge, the behaviorist assumes that teachers will engage in instruction, which from this view is seen as the process of providing knowledge to learners.

Assumptions of Constructivism

Constructivists argue that there are multiple realities constructed by individuals. The human mind does not copy reality from outside directly, rather, it constructs reality (Driscoll, 1994). In other words, there is no shared reality. Constructivists believe that learners actively construct their own knowledge as they try to make sense of their experience (Driscoll, 1994). Knowledge is constructed when an individual creates meaning from his own experience through social negotiation and through his evaluation of the viability of individual understandings (Savery and Duffy, 1996). Constructivists view learning as a construction process that is context dependent. Learners engage in active knowledge construction and interpretation in order to develop understandings of relationships and phenomena in the world (Brooks and Brooks, 1993; Bender, Cunningham, Duffy, and Perry, 1995, Duffy and Cunningham, 1996). In constructivist learning environments, learners should be provided with opportunities to experience cognitive conflict. This is also called "puzzlement," which will help them to develop new schema or understanding through the interpreting process. Duffy and Cunningham (1996) describe learning as "an active process of constructing rather than acquiring knowledge, and instruction as a process of supporting that construction rather than communicating knowledge."

Differences between Behaviorism and Constructivism

Based on the assumptions stated above, one may draw several conclusions about the differences between behaviorist and constructivist epistemologies. Where behaviorism views knowledge as resulting from a finding process, constructivism views knowledge as the natural consequence of a constructive process. Where behaviorism views learning as an active process of acquiring knowledge, constructivism views learning as an active process of

constructing knowledge. Finally, where behaviorism views instruction as the process of providing knowledge, constructivism views instruction as the process of supporting construction of knowledge.

Both behaviorism and constructivism have spawned particular pedagogical approaches. Individually Guided Education was one of the preeminent approaches to grow out of behaviorism, while Problem-Based Learning has been one of the most popular approaches to grow out of the Constructivist movement. Each pedagogical approach has imbedded within it recommendations regarding six core elements of the instructional environment, including 1) learning goals, 2) instructional approaches, 3) teacher's role, 4) students' roles, 5) the role of resources and technology to support learning, and 6) use of evaluation strategies. In this section, IGE and PBL will be compared across these six core elements.

Behaviorist Pedagogy: Individually-Guided Education

In Individually Guided Education (IGE), like other approaches to individualized instruction, teachers diagnose students' entry skills, identify behavioral objectives, and plan a unique and appropriate instructional program to facilitate a student's achievement of the objectives. Team teaching, non-graded classes, and cross-age tutoring are used in the IGE model.

According to Saettler (1990), the IGE system was originally developed by Herbert Klausmeier. The U.S. Office of Education provided funds for large scale implementation of IGE in 1971, and by 1976 there were approximately 3,000 elementary and middle schools using some form of IGE.

Learning Goals

The IGE environment is structured to support three fundamental goals regarding the individual learner: 1) to foster self-determinism, encouraging the individual to take charge of his own destiny, 2) to encourage self-actualization by allowing the individual to act on his own personal needs and desires, and 3) to support self-direction – one should be free from inappropriate mechanisms of control (Romberg, 1985).

The basic assumption of IGE is that the learning of each individual child in these regards must be the focal point of the school (Romberg, 1985). In order to ensure that each individual child learns, it is necessary to provide curricula that are relevant to each student, and to identify behavioral goals for each student so that diagnosis and prescription can be used to measure achievement of goals. In the IGE system, teacher teams ensure that appropriate goals for each student are set, and students are encouraged to achieve these goals, in order to get feedback regarding progress toward goals (Klausmeier, 1975).

Instructional Approaches

Implementation of the IGE system requires that instructional time be spent with teachers and students collectively engaged in a cycle of exploration of individual students' learning styles, motivation levels, and appropriate objectives, engagement in suitable learning activities, and evaluation of the attainment of objectives. In the IGE system, heavy emphasis is placed on allowing variation in instructional approaches, specifically, varying the amount of attention and guidance provided by the teacher, varying the amount of time spent in interaction among students, and varying the amount of time spent by each student in one-to-one interactions with the teacher, independent study, small-group activities, and adult-led large group activities (Klausmeier, 1975).

Teacher Role

In IGE, teachers work as cooperative instructional teams in a multi-unit school organization, in order to plan, implement, and evaluate instructional programs for individual students in the instructional unit (which replaces the traditional age-graded classroom (Jeter, 1981; Romberg, 1985).

Teachers' work involves the organization of learning materials so that students can make effective progress through their learning activities; arrangement of the learning space to allow for students to work alone or together to achieve particular learning goals; keeping efficient records in order to trace each student's individual progress; and helping each student through his unique learning process. Additionally, teachers are responsible for providing resources and removing obstacles so students can learn efficiently (Dell, 1972).

Student Role

The IGE, environment is built upon the assumption of individual differences: no two learners achieve at the same rate; achieve using the same study techniques; solve problems in exactly the same way; possess the same repertoire of behaviors; possess the same pattern of interests; are motivated to achieve to the same degree; are motivated to achieve the same goals; are ready to learn at the same time, or have exactly the same capacity to learn (Duane, 1973).

Building on these assumptions, students in IGE programs have some involvement in planning and carrying out their own organized program. In this regard, the student is not a passive learner, but works actively through many

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activities such as manipulating learning resources, communicating with peers, and engaging in learning activities (Dell, 1972).

Use of resources

Resources play a critical role in IGE environments because they facilitate the variation of instructional approaches that is critical in order to meet each individual students' learning needs. In the instructional programming model for IGE, Klausmeier specifically states variation of instructional approach may be addressed through the use of resources and technologies including printed materials, audiovisual materials, direct experiencing of phenomena, and the use of space and equipment, (Jeter, 1981).

IGE environments are structured so that media are handled directly by learners and are an integral part of the curriculum. A wide variety of media are provided because they are the tools that address individual differences and various learning styles by providing alternative means of achieving objectives (Duane, 1973).

Strategies for Evaluation

IGE is just one of the many individualized instruction approaches that brought popularity and legitimacy to the concept of criterion-referenced evaluation (as opposed to norm-referenced evaluation). The primary purpose of criterion-referenced evaluation in IGE systems is to ascertain the individual learner's status in relation to stated learning goals and performance objectives, rather than to compare the individual to the group. Types of criterion-referenced measures that may be used in IGE environments range from paper-and-pencil tests, performance tests which require the learner to demonstrate capability on a particular task, work samples that demonstrate a student's mastery of an objective, and formal observation by the teacher when achievement of an objective is best measured in a natural setting (Bechtol, 1973).

Constructivist Pedagogy: Problem-Based Learning

Traditional classroom instruction has been criticized because, in this situation, students are passive learners and fail to transfer what they learned in school to daily life outside of the learning environment. Since students passively receive information from teachers, their motivation of learning and retention of knowledge are low. Based on the constructivist view, the problem-based learning approach was begun in medical schools in the mid-1970s to solve the problems of low learning motivation, knowledge retention, and rate of knowledge transfer. In this section, the PBL approach will be outlined as it relates to six elements of instruction.

Goal of Learning

The PBL approach is intended to help students develop learning skills. In order to learn, students must have metacognitive skills, self-directed learning skills, and thinking- and problem solving skills.

PBL educators are concerned about metacognition because they assume that expert problem solvers monitor and control their thinking process in order to be most effective. Metacognition may be defined as thinking about thinking. It's the "executive function in thinking: pondering, deliberating, or reflecting on the problem or situation; reviewing what is known and remembered about the kind of problem confronted; creating hypotheses, making decisions about what observations, questions or probes need to be made; questioning the meaning of new information obtained from inquiry; reviewing what has been learned, what it all may mean and what needs to be done next, etc." (Barrow, 1988, p3).

PBL is also concerned with fostering students' self-directed learning skills so that they will automatically continue their own learning for the rest of their lives (Barrow, 1988). PBL allows students to determine what and how to learn on their own in order to ensure their lifelong learning skills and the ability to be effective and independent learners.

In a PBL approach, students also learn to identify learning issues, develop strategies, locate information relevant to the issue, and evaluate their solution. This entire learning process helps to develop problem solving and thinking skills (Savery and Duffy, 1996).

Instructional approaches

Constructivists rarely use the term "instructional strategy," rather, they talk about principles of learning that can be applied across content areas. The instructional principles which constructivists consider ideal for facilitating the student's knowledge construction process are apprenticeship, situated cognition and authentic learning, as well as cooperative learning and social negotiation.

In an apprenticeship learning environment learners are faced with a real world situation that allows them to learn from doing. The apprenticeship environments "enculturate students into authentic practices through activities and social interaction" (Brown et al., 1989). Because learning is a construction of meaning in context and is context-dependent, students learn best in an authentic and cooperative learning environment. The goal of cooperative learning is to share alternative viewpoints and to challenge alternative points of view (Duffy and Cunningham,

1996). In social negotiation learning situations, students share their experience with others and expose themselves to multiple perspectives which help them to "judge the quality of their own solutions and to learn perhaps more effective strategies for problem solving" (Driscoll, 1994).

Role of the teacher

The teacher's role in a PBL approach has changed from the traditional information disseminator to an active curriculum designer and learning facilitator (Barrows and Myers, 1993). As a curriculum designer, the teacher selects learning problems to reflect curriculum objectives and real-world issues. As a learning facilitator, he uses instructional strategies such as reflecting, coaching, questioning, and modeling to perturbate student's thinking and help them to see the conflict in their thought, in order to accomplish negotiated meaning and solutions.

The facilitation skills required of the teacher are reflecting, posing problems, questioning, modeling, choosing appropriate strategies and assessing learning (Hawley, Hsu, McCall, and Schuh, 1997). According to Savery and Duffy (1996), the teacher is a facilitator rather than a subject matter expert. He needs to develop student's thinking and reasoning skills and help them to become self-directed learners. During the metacognitive learning process, the facilitator challenges students' level of understanding and relevance of student-generated issues, rather than leading them to the correct answer. Kalishman and Mennin (1993) describe the relationship of student and facilitator as one in which student and tutor work collaboratively together, and where the student demonstrates level of mastery while the tutor provides supportive and corrective guidance specific to the task undertaken.

Role of the student

In a PBL environment, students are active learners. Students work in small groups on a problem presented by the teacher. Students need to internalize and reason through the problem to identify the learning issues and define the objectives. As tasks and work schedule are assigned to each group member, they start to identify resources to gather information related to the learning issues. Each member brings back and reports his findings for the whole group to analyze the data or to shape their learning issues in order to identify the solutions. Once students synthesize and summarize findings into solutions, they need to conduct an assessment to see if all the objectives have been satisfied and to evaluate their performance. Finally, they receive feedback from the teacher/facilitator (Gallagher, 1997; Savery and Duffy, 1996; West, 1992).

Use of resources

Resources play a crucial role in the learning process, because students are responsible for using data in order to solve problems. Having access to multiple resources helps students to shape their learning issues and to more clearly see the problems they face from different perspectives. The problem situation is pre-designed by the teaching team and problem information is distributed to students as needed through the learning process (Stepien, Gallagher, and Workman, 1993). In some cases students are provided with a list of resources from the teacher, while in other situations students need to identify possible resources by their own (West, 1992). PBL requires students to use real-world resources including books and databases, local resources and experts, journals, and internet consultations (Boyce, VanTassel-Baska, Burruss, Sher, & Johnson, 1997). The local resource or experts may be mentors in the surrounding communities who agree to talk with students. Regarding the use of computers, De Corte (1994) describes the role of the computer as a supportive system that allows more student-control and induces effective forms of interaction and cooperation.

Strategies for evaluation

According to Barrow and Tamblyn (1980), evaluation should be an integral part of the learning process so that students will be aware of the learning needs and continuously receive feedback. Their idea corresponds to Duffy and Cunningham's (1996) claim that assessment should be "ongoing, rather than just being an end of the semester rating."

In respect to what should be assessed, Norman (1991) claims that the central role of PBL is the acquisition of problem solving skills. Therefore, it is important to evaluate students' problem solving skills independent of knowledge. Duffy and Cunningham (1996) suggest the use of peer and self-assessment to assess students' skills as problem solver, self-directed learner, and as team member. Norman suggests that essay exams and problem-based oral exams are good tools to assess students' problem-solving and self-directed learning skills. Additionally, Norman suggests that students should be evaluated in the context of problem solving, so that contextual clues to the situation are available.

Comparison of IGE and PBL approaches

Table 1identifies some similarities, as well as some differences, between the IGE and PBL pedagogical approaches, as they relate to six key elements of the instructional environment. It is important to note that it is not possible to make exact comparisons between IGE and PBL for each of these elements. Despite this, it would seem

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appropriate to conclude that, though there is a time span of 20 years between these approaches, they do encourage similar emphases related to learning and instruction. The conclusion section of the paper specifically identifies the commonalties in these two pedagogical approaches.

Table 1: Summary comparison of instructional elements as prescribed by IGE and PBL approaches

	IGE	PBL
Learning Goals	Develop students' capabilities in: • Self-determinism • Self-actualization • Self-direction	Develop students' capabilities in: • Metacognition skills • Self-directed learning skills • Thinking skills and problem-solving skills
Instructional Approaches	Instruction as: • Cooperative Instructional Teams • Multi-unit school organization • Variations in pace, structure • Cycle of objectives and evaluation	Instructional principles regarding: • Cooperative learning & social negotiation • Apprenticeship • Situated cognition • Authentic learning
Role of the teacher	Teachers facilitate learning through: • Meaningful learning activities • Removing obstacles to learning Teaching activities include: • Assessment of learning • Exploration • Providing resources • Helping students through unique learning situations	As a facilitator to: • Show student how to construct knowledge • Create an instructional environment where learner's processes of situational sense making are enhanced Facilitation skills include: • Assessing learning • Reflecting • Posing problem • Questioning • Modeling • Choosing appropriate strategies
Role of students	• Plan learning program • Organize learning activities • Engage in learning activities • Manipulate resources • Communicate with peers	• Define problem and identify issues • Frame learning objectives • Determine work schedule • Gather and analyze data • Present and discuss learning findings • Synthesize findings into solutions • Justify solution and evaluate performance •
Use of Resources	Types of resources include: • Print materials • Audiovisual materials • Technological equipment • Direct experience	Types of resources include: • Books and databases • Journals • Computers and Internet • Local resources and experts
Evaluation Strategies	Evaluation should include: • Criterion-referenced measures • Observation in natural settings • Work samples	Evaluation should include: • Problem solving skills • Self-directed learning skills • Skills as a group member

Conclusion

It may seem counter-intuitive to report that the very different epistemologies of behaviorism and constructivism lead to some important similarities between IGE and PBL pedagogical approaches. Yet, the conclusion of this study is that, regardless of differences related to historical context and to terminology, there appear to be common pedagogical prescriptions between IGE and PBL as they relate to six core elements of instruction.

With regard to learning goals, both IGE and PBL prescribe that curricula should in some way be relevant to individual learners, that learners should have some reason to buy-in to the learning experience, and finally, that building self-directed learning skills is a crucial outcome of learning.

Regarding instructional approach, IGE and PBL both acknowledge the importance of students' active involvement in the activities of the classroom.

With regard to teacher role, both IGE and PBL emphasize the teacher's role as guide for students, and not as a source of knowledge. The teacher's responsibility is to create an environment where students can do their own learning.

With regard to students' roles, both IGE and PBL emphasize respect of individual differences, and therefore students' right to have a say in their own educational experience.

Regarding resource and technology utilization, IGE and PBL both value the creation of resource-rich environments in order to address individual differences and to foster richer and more complex learning.

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Finally, with regard to evaluation strategies, both IGE and PBL approaches appear to be united in the view that norm-referenced evaluation is at best, an inappropriate evaluation strategy.

Perhaps the findings of this study indicate that good pedagogical principles stand above or apart from epistemological differences. It seems, then, that the challenge for all educators, regardless of avowed epistemological views, should be to work toward the creation of educational environments that are based upon sound pedagogy, as modeled by both IGE and PBL approaches.

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